REMARKS

Applicants appreciate the thoroughness with which the Examiner has examined the above-identified application. Reconsideration is requested in view of the amendments above and the remarks below.

Rejection under 35 USC § 112, second paragraph

Claims 3 and 4 stand rejected under 35 USC 112, second paragraph, for being indefinite. Applicants have deleted the terms "which has excellent low temperature impact properties" and "rapidly" in claim 3. Applicants believe that this rejection is now obviated.

Rejection under 35 USC § 102

Claims 1-4 stand rejected under 35 USC § 102 as being anticipated by Kanisawa et al. U.S. Patent Publication No. 2002/0040744. Applicants respectfully traverse this rejection.

Applicants have amended method claim 3 to recite that the step of heating steel of the specified composition to the Ac3 transformation point or higher is without plastic deformation, so that an austenite grain size is 5 – 20 µm is achieved. Support is found in the specification, wherein otherwise conventional heating to the Ac3 transformation point or higher is described without any plastic deformation occurring during the heating (e.g., see paragraph 0013).

Applicant is submitting herewith a Declaration under Rule 132 of the inventor, Soon-Tae Ahn, that evidences the differences between Kanisawa's disclosed wire and that of the present invention, and the unexpected advantages of the latter over the cited prior art.

The claimed method of the present invention is distinguished from the prior art Kanisawa process, wherein the heating is performed while hot rolling the steel wire. Kanisawa describes in paragraph 0033 the hot rolling of the steel to a finish rolling temperature from the Ar_3 transformation temperature to 200°C above it.[1] Kanisawa also describes in the same paragraph that such hot rolling process produces a prior austenitic grain size of 11 or above. Although the achieved austenite grain size overlaps with applicants' invention, Kanisawa's processes for obtaining the fine grain is different. Accordingly, Kanisawa not only does not disclose applicant's heating step that occurs without plastic deformation, but in fact *teaches away* from applicants' process as defined in claim 3.

Kanisawa also does not disclose applicants' claimed tempering parameter (P) ranging from 21,800 to 30,000. P is expressed by the equation:

$$P = 1.8 \times (T + 273) \times (14.44 + \log t)$$

wherein, T is a tempering temperature expressed in °C and t is a tempering time expressed in sec.

As such, Kanisawa does not anticipate applicants' method of claim 3.

Moreover, applicant's composition with the resultant claimed properties, as defined in claims 1 and 3, is not anticipated by or obvious from Kanisawa. The present invention solves the problem of dramatically deteriorated impact properties when a conventional steel wire for cold forging is used as in automobiles or other devices in a severely cold regions by providing a steel wire having high impact properties of 60

[1] The present invention specifies the "Ac3" transformation temperature, while Kanisawa specifies the "Ar_3" transformation temperature. The "c" in applicants' term Ac_3 is taken from the French term "chauffage" having a meaning of heating and the "r" in Kanisawa's term Ar_3 is taken from the French term "refroidissement" having a meaning of cooling.

J/cm^2 or more at a cryogenic temperature of -40°C, even though the hot-rolled steel wire is quenched and tempered with high tensile strength of 70 - 130 kgf/mm^2. By contrast, the object of Kanisawa is to provide a steel wire rod for cold forging which can be applied to spheroidizing annealing without a preliminary drawing that is conventionally conducted before the annealing. Notwithstanding overlap in composition and prior austenitic grain size range, the Kanisawa steel wire is incapable of achieving the unexpectedly advantageous claimed properties of applicants' invention.

The differences may be explained by reference to Kanisawa' described treatment processes and reported properties for the steel wire. Kanisawa employs a hot rolling process in which billets of 162 mm x 162 mm in section were heated at a high temperature and continuously plastically deformed by hot rolling into wire rods 11 mm in diameter. The finish hot rolling was at a relatively low temperature of from Ar_3 to 200°C above it (800°C) in order to reach the final size, following by being rapidly cooled and then tempered at 500°C. After tempering, the wire underwent spheroidizing annealing at the retention temperature of 740°C for a resident time of 17 hours. Kanisawa, Example 1 and Table 2.

The combination of tensile strength and impact absorption energy as defined in the claims of the present invention is also not disclosed or suggested by Kanisawa. Although the steel wire rod produced by Kanisawa immediately after hot rolling, rapid cooling and tempering in Table 3 shows a tensile strength similar with that of the present invention (up to 978 MPa = 99 kgf/mm^2), the steel wire rod cannot be applied to cold forging. Instead, Kanisawa teaches that the wire must undergo spheroidizing annealing, in which case the tensile strength level of the steel wire after annealing and

before the cold forging is considerably lower (up to 568 MPa = 57 kgf/mm^2) than applicants' claimed range of 70 - 130 kgf/mm^2.

Notwithstanding the Examiner's opinion, applicants submit that the impact absorption energy of Kanisawa's wire immediately after tempering would not have been at least 60 J/cm^2 at -40°C. This is because the method for obtaining the prior austenite grain in Kanisawa is completely different from that in the present invention (hot rolling versus no plastic deformation in the present invention), the Kanisawa microstructure (including the prior austenite grain) immediately after quenching has considerable stress because of severe plastic deformation during hot rolling in low temperature. These stresses will be hardly relieved even though the structure is tempered after quenching, so Kanisawa acknowledges that the wire must be further spheroidized annealed before it is capable of being cold forged.

By contrast, the microstructure of the present invention does not have Kanisawa's stress in it during the heat treatment step, and therefore has greater ductility. Applicants' claimed impact absorption energy of at least 60 J/cm^2 at -40°C requires significantly more ductility than what is obtained by Kanisawa immediately after tempering.

Although Kanisawa's wire ductility is improved after spheroidizing annealing (when it is ready for cold forging), the tensile strength level of up to 568 MPa (57 kgf/mm^2) is considerably lower than applicants' claimed range of 70 - 130 kgf/mm^2. In summary, Kanisawa only achieves applicants' claimed tensile strength when it has an impact absorption energy lower than applicants' claimed range of at least 60 J/cm^2 at -40°C, and Kanisawa only achieves applicants' claimed impact absorption energy when it has a tensile strength lower than applicants' claimed range of 70 - 130 kgf/mm^2.

Only applicant has disclosed and claimed a steel wire for cold forging that has the superior combination of impact absorption energy of at least 60 J/cm^2 at -40°C and a tensile strength of 70 - 130 kgf/mm^2.

Applicants have amended claims in this application. Applicants are not conceding in this application that the claims as they stood prior to amendment are not patentable over the art cited by the Examiner, as the present claim amendments and cancellations are only for facilitating expeditious prosecution and allowance of the claims. Applicants respectfully reserve the right to pursue these prior and other claims in one or more continuation and/or divisional patent applications.

It is respectfully submitted that the application has now been brought into a condition where allowance of the entire case is proper. Reconsideration and issuance of a notice of allowance are respectfully solicited.

Respectfully submitted,

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